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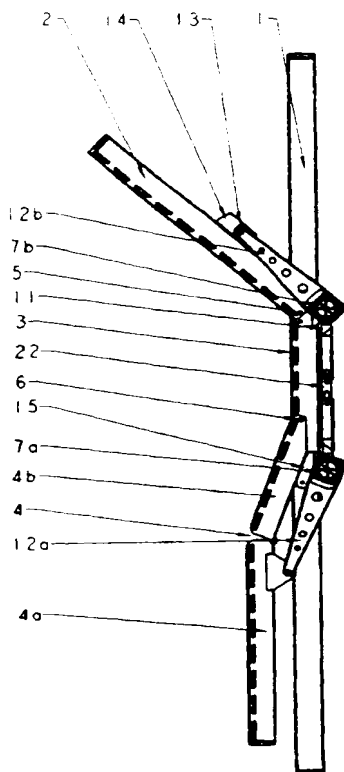
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(54) Title: ROTARY ACTUATOR; ESPECIALLY FOR ADJUSTABLE SEPARATE BOTTOMS TO BEDS AND BEDS AS WELL AS A CONSTRUCTION WITH SUCH A ROTARY ACTUATOR



(57) Abstract: A rotary actuator, preferably for adjustable separate mattress supports and beds, comprises an electric motor which, via a transmission, drives a rotatable mounting bracket (11) intended to be secured to a movable part (2, 4), in a structure in which the actuator is incorporated, as well as a fixed mounting bracket (12) intended to be secured to a stationary part (1) of the structure. The fixed mounting bracket (12) is secured via a profile, preferably an angular profile or V-profile, to the stationary part (19), wherein a side of the profile serves as an engagement face for the bracket and secures it against rotation in the usual operational state of the actuator, but allows rotation if the rotary part is obstructed in its rotary movement. This provides a jamming protection arrangement which has a simple structure and mode of operation. In a special embodiment with two rotary actuators, the fixed brackets are interconnected with a common profile so that the moment forces are not transferred to the structure in which they are incorporated. This is particularly important in case of mattress supports where the frame is of flimsy wood or other reasons.

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ROTARY ACTUATOR; ESPECIALLY FOR ADJUSTABLE SEPARATE
BOTTOMS TO BEDS AND BEDS AS WELL AS A CONSTRUCTION
WITH SUCH A ROTARY ACTUATOR.

5 The present invention relates to a rotary actuator, preferably for adjustable separate mattress supports and beds, said actuator comprising an electric motor which, via a transmission, drives a rotatable mounting bracket, preferably shaped as an arm intended to be secured to a
10 movable part, in a structure in which the actuator is incorporated, as well as a fixed arm intended to be secured to a stationary part of the structure.

Rotary actuators of this type may be used for performing
15 movements and positional adjustments in articles of furniture, including beds and separate mattress supports, care beds, hospital beds, nursing equipment, seats for vehicles, machinery and within the industry. German Utility Model DE 298 02 384 U1 discloses a mattress support
20 with incorporated rotary actuators for adjusting the backrest part or the legrest part.

It is unfortunate if something gets jammed between the rotating part and the stationary part of the structure,
25 which may cause damage to the structure and the jammed article or object if the movement is not stopped. Of course it is even more unfortunate if personal injury occurs.

30 The object of the invention is to provide a rotary actuator of the type stated in the opening paragraph and provided with a jamming protection arrangement.

This is achieved according to the invention in that the fixed mounting bracket of the actuator co-operates with a profile having a configuration which secures the bracket against rotation in the usual operational state of the actuator, but allows rotation if the movable part is obstructed in its rotary movement. Thus, if something gets jammed between the movable part and the stationary part of the structure, then the movable part will stand still, while the otherwise fixed mounting bracket will begin to rotate. It will hereby be realized quickly that something has got jammed in the structure so that the rotary movement can be stopped and harmful damage be avoided, to the structure as well as to the object which has got jammed. As will readily be realized, the jamming protection arrangement may be configured so that it is easy to mount. Moreover, it can be configured so that it can be manufactured at a reasonable cost.

Special embodiments of the actuator are defined in the dependent claims 2-7 and are explained more fully in connection with the example discussed below.

Claim 8 defines a structure, preferably a separate mattress support or bed, comprising a stationary part and at least one part adjustable by means of a rotary actuator according to one of claims 1-7, said actuator being secured to the stationary part with the fixed mounting bracket and to the adjustable part with the rotatable mounting bracket.

30

In structures in which two actuators must be included, such as mattress supports with adjustable backrest and legrest parts, it is expedient to arrange these so that the fixed arms may be interconnected with a common pro-

file. The moments in the arms are hereby transferred to the common profile, which is an advantage when the stationary part of the structure is flimsy in general. This is e.g. the case with mattress supports where, for other reasons, the frame is of relatively flimsy wood. Of course, it is advantageous that the arms are disposed on a straight line in that case, so that a rectilinear profile may be used, but it is not an absolute necessity.

10 In the event of a mattress support exclusively with an adjustable backrest part, it may still be advantageous to use a profile which is then secured at the free end to a transverse connection in the bed frame, which may merely be a transverse rod secured in the side members of the
15 frame.

The invention will be explained more fully below with reference to the embodiment illustrated in the accompanying drawing. In the drawing:

20 Fig. 1 shows a mattress support intended to be placed or incorporated in a bed,

fig. 2 shows a rotary actuator in its entirety,

25 fig. 3 shows a connection between two actuators of the mattress support, seen from the side,

fig. 4 shows the connection of fig. 3 seen from above,

30 fig. 5 shows a section along the line V-V in fig. 3,

fig. 6 indicates the position of the actuator when something has got jammed, and

fig. 7 shows a part of a bed frame in another embodiment of the invention.

- 5 The embodiment comprises an adjustable mattress support intended for home beds. The mattress support replaces the slatted bed case, which is otherwise included in a bed.

10 The mattress support shown in fig. 1 comprises an outer frame 1 which includes a mattress support portion consisting of a pivotable backrest part 2, a fixed central part 3, and a legrest part 4 which is articulated. The central part 3 is secured to the sides of the outer frame 1.

15 The backrest part 2 is pivotable about a shaft 5 likewise secured at the sides of the outer frame 1, and correspondingly the legrest part is pivotable about a shaft 6. Both the backrest part 2 and the legrest part 3 perform
20 their movements with a rotary actuator 7, as shown in fig. 2. The rotary actuator comprises a pipe 10 of quadrangular cross-section that accommodates an electric motor, which is connected with an arm 11 via a transmission. An arm 12 is secured at each end of the
25 pipe 10. At the backrest part 2, the arm is equipped with a wheel 13 which is guided in a guide rail 14 secured to the backrest part. The pipe 10 is rotatably mounted about its longitudinal axis in a bracket 15 secured at each side of the outer frame 1. As the other arm 11 of the
30 actuator is fixed, the pipe 10 and the arms 12 secured on the end thereof will rotate when the actuator is activated. The arms 12 will hereby raise or lower the backrest part, as this will pivot about its shaft 5. The legrest part is raised and lowered in a corresponding

manner, as the ends of the arms 12a on the actuator 7a of the legrest part are rotatably secured to a bracket on the outermost link 4a of the legrest part. Activation of the actuator will cause the legrest part 4 to be raised or lowered, as the arm 12a will cause the innermost link 4b to rotate about the shaft 6 through a raising and rotating movement of the outermost link 4a of the legrest part.

10 The actuators 7a, 7b of the backrest part and the legrest part are identical, they are merely rotated 180° relative to each other so that their arms are disposed at the same side of the mattress support. In the plane state of the mattress support portion, the arms 11 are disposed on a
15 straight line and point toward each other. This is readily possible in that the arms are symmetrical about their longitudinal axes. Each arm 11, only one is shown in figs. 3-5, is connected with a U-profile 21a via a rivet 20. The arm 11 and the U-profile 21a are mutually ro-
20 tatable about the rivet 20 as a shaft. The U-profile 21a, 21b from each arm is mounted in a U-rail 22. The profile 21a, 21b and the rail 22 are assembled by a pin 23a, 23b which can move in a slot 24a, 24b at both sides of the rail 22. The load on the other arms 12 will try to tilt
25 the arms 21 upwards, but is prevented from doing this in that the arms hit the bottom of the U-profile 21. The rod connection 11, 21, 22 will relieve the outer frame of the mattress support, which should preferably be as thin as possible for other reasons and is typically of wood.

30

Of course, it is only at the end where the arm 11 is secured that the profile 21a needs to have the stated cross-section, otherwise, the remaining length of the profile may have another cross-section.

The two rotary actuators are connected to a power supply, which is in turn connected to the mains, and they are controlled from a manual control or other control panel via a control box.

To raise the backrest part, the rotary actuator is activated via the manual control, whereby the quadrangular pipe/the actuator housing begins to rotate, and the two arms at the ends thereof will raise the backrest part. When the backrest part is lowered, this takes place under usual conditions of operation in the same manner.

If, however, something gets jammed between the backrest part 2 and the outer frame when the backrest part is lowered, the arm 11 will begin to rotate upwards, since the other arm 12 is obstructed in its downward movement, cf. fig. 6. The arm 11 will partly press the U-profile upwards and partly push it outwards, thereby causing the pin 23a to slide in the slot 24a. The immediate visible indication to the user that something has got jammed is that the backrest part stands still, so that the user can stop the actuator and remove the jammed object, optionally by first rotating the backrest part a distance upwards. The same applies if something has got jammed at the legrest part. The connection between the two actuators thus serves as a jamming protection, as a safeguard against damage both to the structure itself and to the object which has got jammed.

30

In an embodiment of the invention with two actuators, the connection pipe between these is a closed profile, and the bending movement caused by an object which has got

jammed, is absorbed as an elastic bending in the connection pipe.

If the frame of the mattress support alternatively the
5 frame of the bed is sufficiently rigid and strong to be
able to transfer the forces, as is the case with hospital
beds, the invention may be realized as indicated in fig.
7 by mounting an angular member on the side of the frame.

10 It will be appreciated that the invention may be realized
in other connections than beds or mattress supports, and
it will also be appreciated that the invention may be im-
plemented in various configurations. For example, it may
be mentioned that if a bed or a mattress support just has
15 an adjustable backrest, the end of the U-rail may be se-
cured to the bed structure. In this embodiment, the
structure is also suitable for a chair. In the foregoing,
the structure is configured such that the pipe 10 with
arms 12 rotates, but nothing prevents the reverse, viz.
20 that the arms 11 perform the movement, while the pipe 10
with the arms 12 is secured.

P a t e n t C l a i m s :

1. A rotary actuator, preferably for adjustable separate
5 mattress supports and beds, said actuator comprising an
electric motor which, via a transmission, drives a ro-
tatable mounting bracket, preferably shaped as an arm
(12) intended to be secured to a movable part (2, 4), in
a structure in which the actuator is incorporated, as
10 well as a fixed arm (11) intended to be secured to a sta-
tionary part of the structure, c h a r a c t e r i z e d
in that the fixed mounting bracket (11) co-operates with
a profile (21) having a configuration which secures the
bracket against rotation in the usual operational state
15 of the actuator, but allows rotation if the movable part
is obstructed in its rotary movement.
2. A rotary actuator according to claim 1, c h a r a c -
t e r i z e d in that the mounting brackets are shaped
20 as arms (11, 12), preferably symmetrical about their re-
spective longitudinal axes.
3. A rotary actuator according to claim 1 or 2,
c h a r a c t e r i z e d in that the profile (21) is
25 formed by an angular profile or U-profile, where a side
of the profile serves as an engagement face for the
mounting bracket (11) and secures it against rotation in
the usual operational state of the actuator.
- 30 4. A rotary actuator according to claim 3, c h a r a c -
t e r i z e d in that the fixed arm (11) is rotatably
secured to a first side of the profile (21), while a sec-
ond side transversely to the first side of the profile
serves as an engagement face for the arm.

5. A rotary actuator according to claim 4, c h a r a c -
t e r i z e d in that the fixed arm (11) is secured to
the profile (21) by a bolt, rivet or the like (20), which
5 serves as a rotary shaft, and that the end of the arm is
rounded at least with a quarter of a circular arc toward
the transverse side of the profile.
6. A rotary actuator according to one of claims 1-5,
10 c h a r a c t e r i z e d in that the end of the profile
(21) is telescopically inserted into the end of a pipe
profile, preferably of quadrangular cross-section.
7. A rotary actuator according to one of claims 1-5,
15 c h a r a c t e r i z e d in that the end of the profile
(21) is inserted into a U-rail (22) and secured by a
shaft (23) inserted into a slot (24) in the rail.
8. A structure, preferably a separate mattress support
20 or bed, comprising a stationary part and at least one
part adjustable by means of a rotary actuator according
to one of claims 1-7, said actuator being secured to the
stationary part with the fixed mounting bracket and to
the adjustable part with the rotatable mounting bracket
25 (12).
9. A structure according to claim 8, c h a r a c t e r -
i z e d in that it is equipped with at least one actua-
tor according to claim 2 or 3, wherein its fixed arm (11)
30 is connected to or co-operates with a profile secured to
the structure.
10. A structure according to claim 8, c h a r a c -

t e r i z e d in that it is equipped with two actuators according to one of claims 4-7, wherein their fixed arms (11) are interconnected with a common profile (22).

- 5 11. A structure according to claim 10, c h a r a c -
t e r i z e d in that the arms (11) are disposed on a straight line, preferably in an end position of the movable parts.

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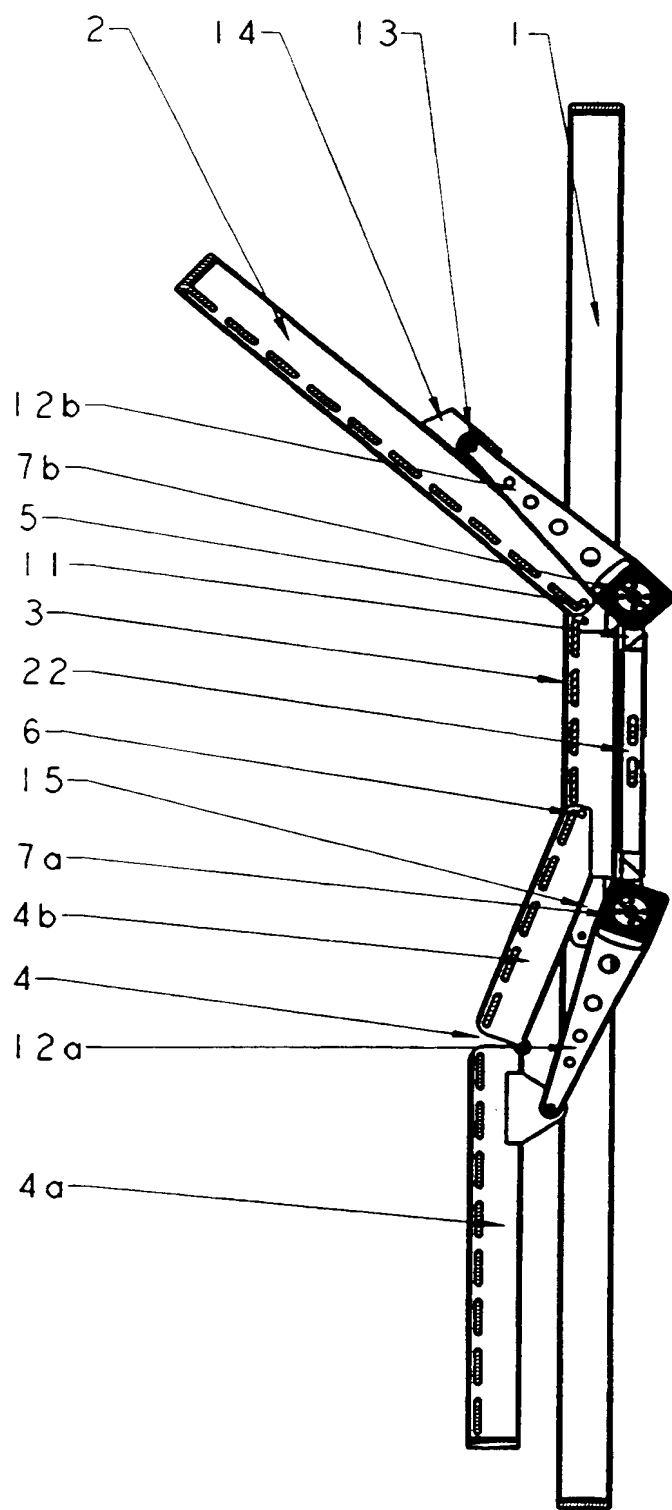


Fig. 1

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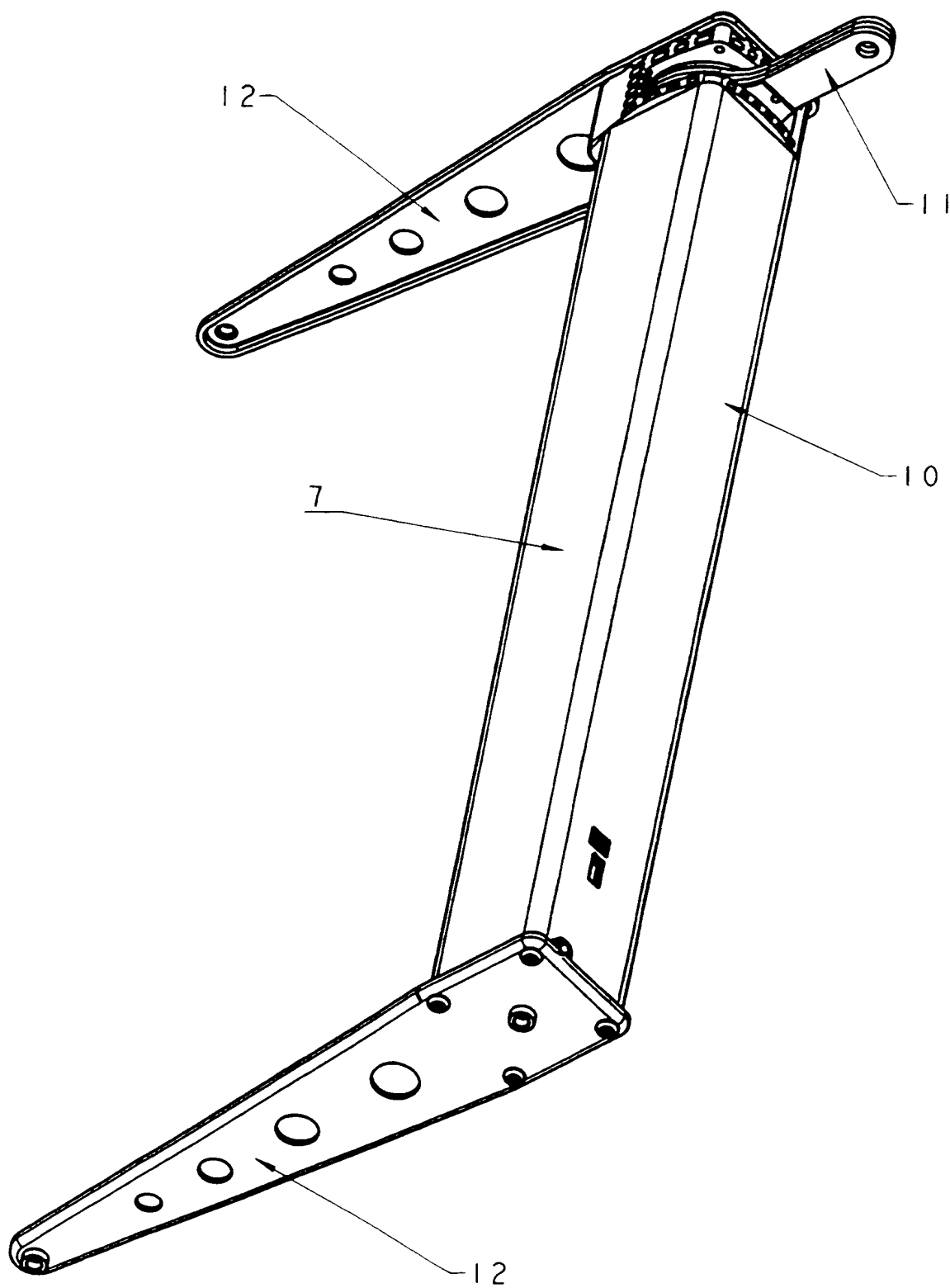
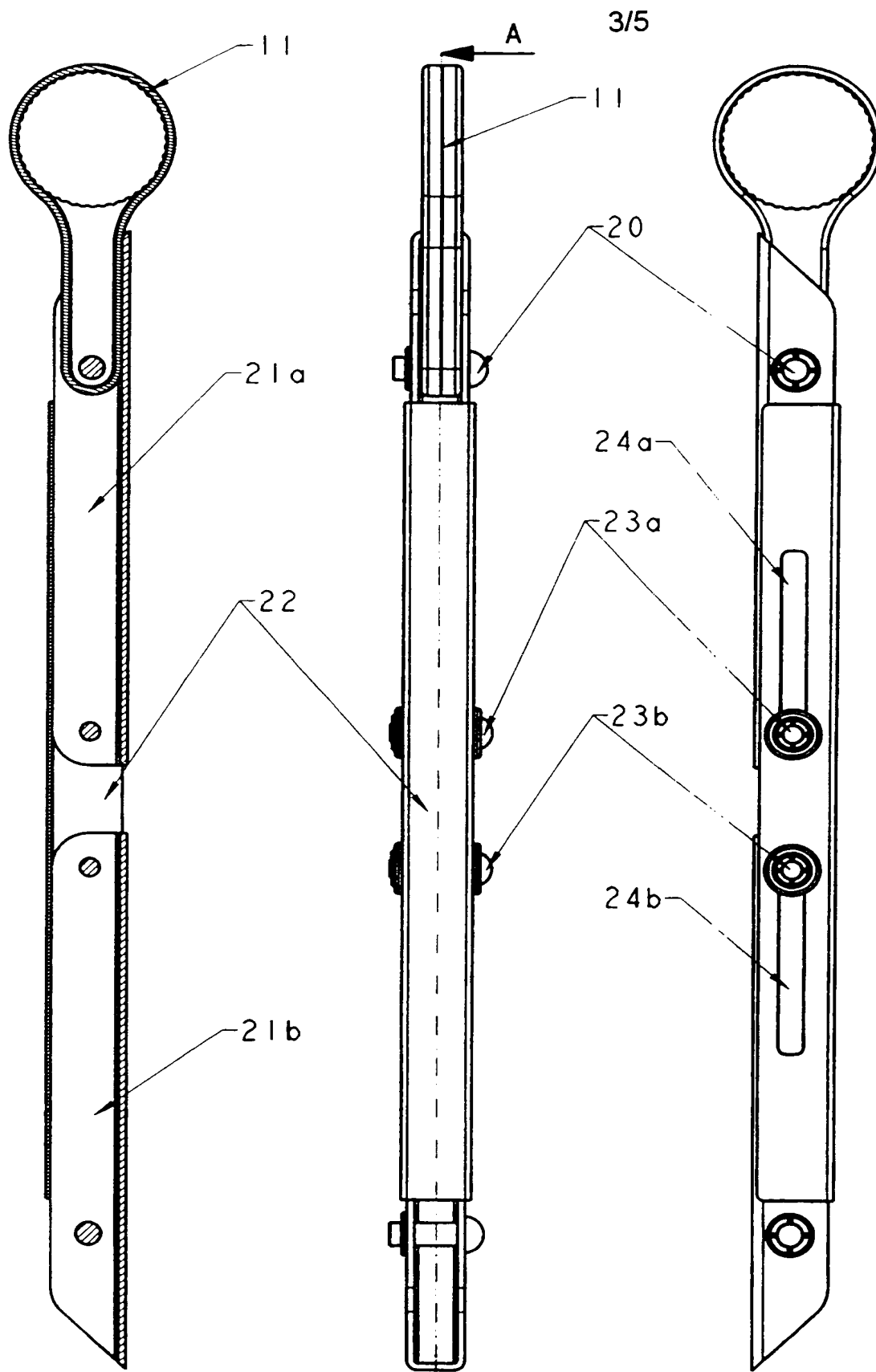


Fig. 2



SECTION A-A
Fig. 5

Fig. 4

Fig. 3

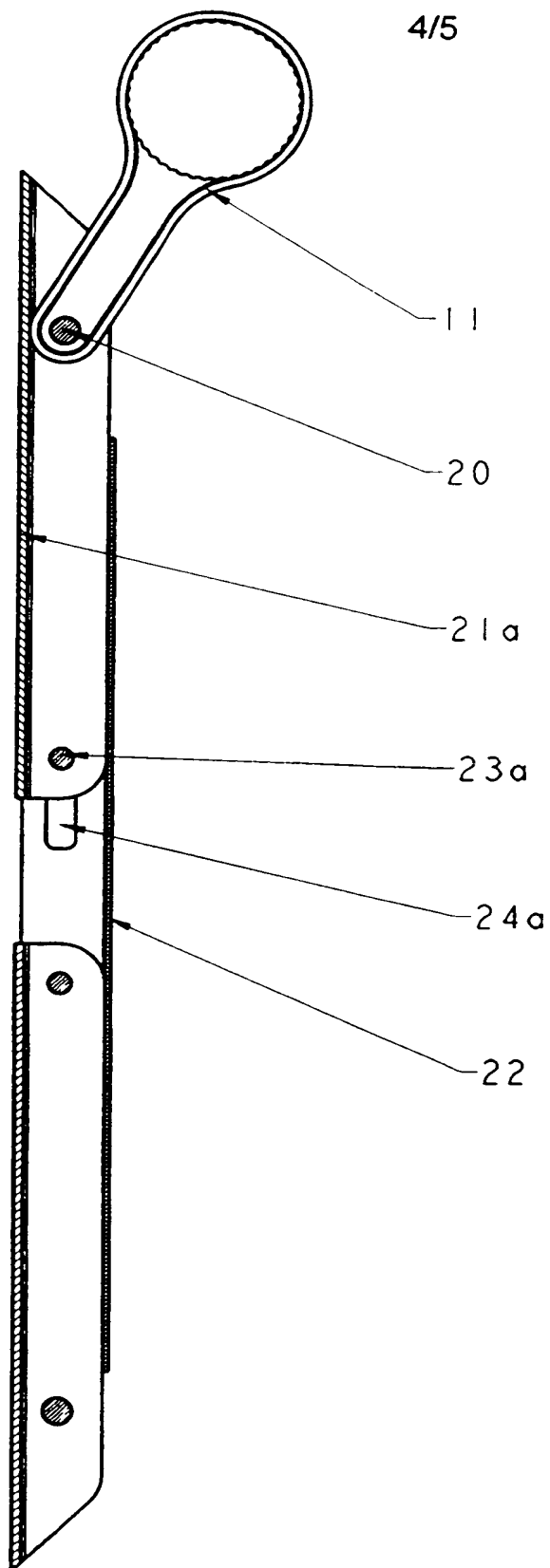


Fig. 6

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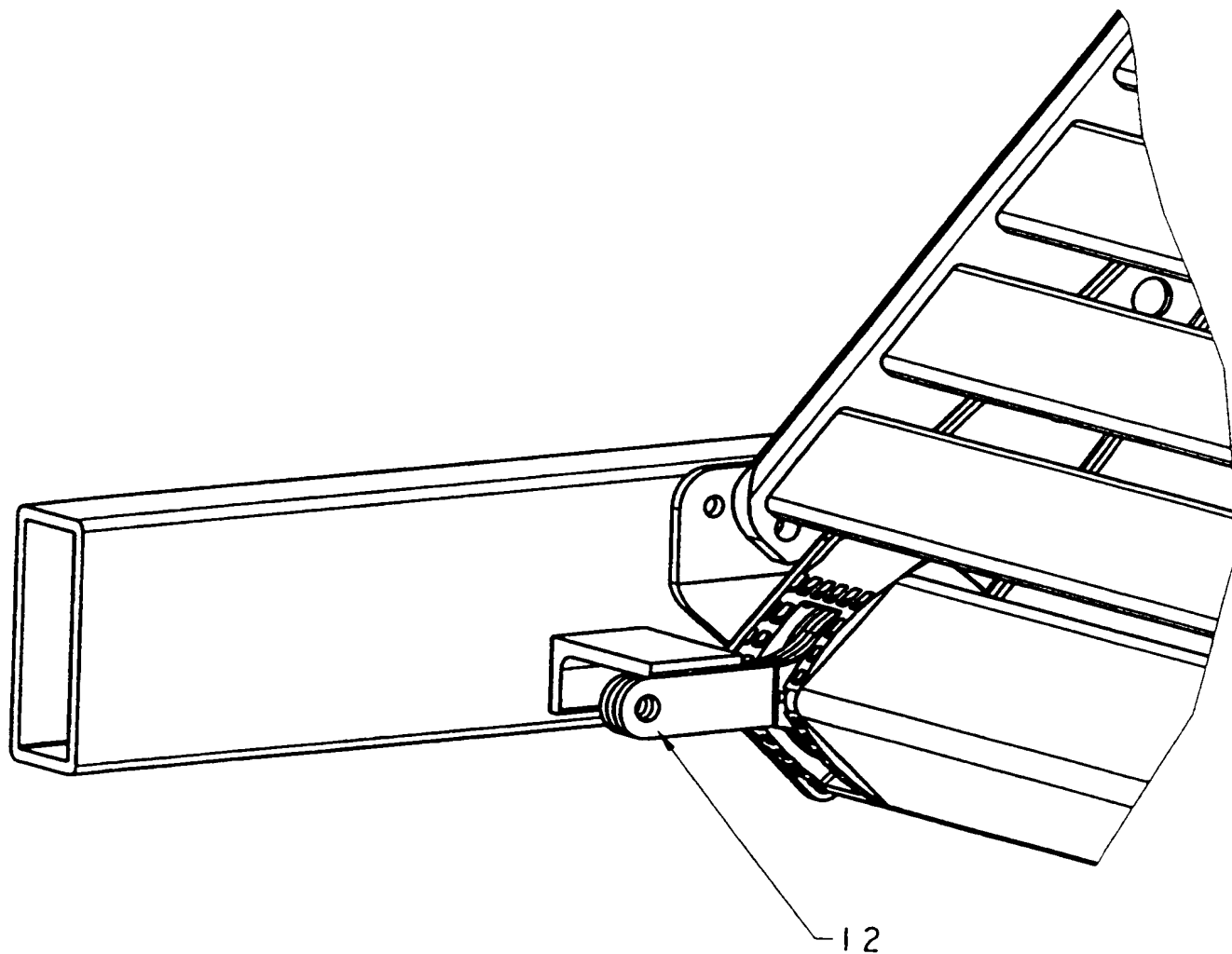


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/DK 00/00483

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A47C 20/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A47C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 4407030 A1 (ELSLER T - DISPLAY KEG), 14 Sept 1995 (14.09.95), see whole document --	1-11
A	DE 19603539 A1 (KOCH,DIETMAR), 22 August 1996 (22.08.96), see whole document --	1-11
A	GB 2205232 A (EGERTON HOSPITAL EQUIPMENT LIMITED), 7 December 1988 (07.12.88), see whole document --	1-11
A	DE 2746281 A1 (SEHP MATIFAS), 22 March 1996 (22.03.96), see whole document -- -----	1-11

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT
Information on patent family members

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Patent document cited in search report			Publication date	Patent family member(s)	Publication date
DE	4407030	A1	14/09/95	NONE	
DE	19603539	A1	22/08/96	DE 29502658 U FR 2730616 A,B US 5675849 A	08/06/95 23/08/96 14/10/97
GB	2205232	A	07/12/88	GB 8712619 D	00/00/00
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